WHAT IS CLAIMED IS:

1. A method of determining the diluent (nitrogen and carbon dioxide) concentrations in a natural gas, comprising the steps of:

storing a database representing a number of reference natural gas mixtures whose molecular weights and carbon dioxide and nitrogen concentrations are known;

modeling the molecular weight of a gas mixture as a function of the speed of sound in the gas mixture, the carbon dioxide concentration, the nitrogen concentration, and a set of constant values, thereby obtaining a model equation;

at a first temperature and pressure state of the gas mixture: measuring the speed of sound in the gas mixture, determining the constant values for the gas mixture from the database, and substituting these values into the model equation, thereby obtaining a first equation for the molecular weight of the gas;

at a second temperature and pressure state of the gas mixture: measuring the speed of sound in the gas mixture, determining the constant values for the gas mixture from the database, and substituting these values into the model equation, thereby obtaining a second equation for the molecular weight of the gas;

at a third temperature and pressure state of the gas mixture: measuring the speed of sound in the gas mixture, determining the constant values for the gas mixture from the database, and substituting these values into the model equation, thereby obtaining a third equation for the molecular weight of the gas; and

solving the three equations for the diluent concentrations of the gas.

2. The method of Claim 1, wherein at least one of the states is standard temperature and pressure.

3. The method of Claim 1, wherein the model equation is expressed as:

$$MW = (A + B/S + C/S^2) * (1 + D*X_{CO2} + E*X_{N2}).$$

4. The method of Claim 1, wherein the constant values D and E are further expressed as:

$$D = D_0 + D_1/S + D_2/S^2 \text{ and } E = E_0 + E_1/S + E_2/S^2.$$

5. The method of Claim 1, wherein the constants are determined by storing pre-calculated speed of sound values for the reference gases for a range of temperature and pressure values, and applying statistical methods to the stored values.

6. The method of Claim 1, wherein the constants are determined by storing pre-calculated speed of sound values for the reference gases for a range of temperature and pressure values, interpolating the data to determine speed of sound at a given state, substituting molecular weight, speed of sound, and diluent concentration values into the model equation for each of the reference gases, and solving the resulting system of equations for the constant values.

7. The method of Claim 1, wherein the constants are determined by calculating speed of sound values for the reference gases for the measured temperature and pressure values, substituting molecular weight, speed of sound, and diluent concentration values into the model equation for each of the reference gases, and solving the resulting system of equations for the constant values.

8. A method of determining the combined diluent concentrations in a natural gas, comprising the steps of:

storing a database representing a number of reference gas mixtures whose molecular weights and diluent concentrations are known;

modeling the molecular weight of a gas mixture as a function of the speed of sound in the gas mixture, the diluent concentrations, and a set of constant values, thereby obtaining a model equation;

at a first temperature and pressure state of the gas mixture: measuring the speed of sound in the gas mixture, determining the constant values for the gas mixture from the database, and substituting these values into the model equation, thereby obtaining a first equation for the molecular weight of the gas;

at a second temperature and pressure state of the gas mixture: measuring the speed of sound in the gas mixture, determining the constant values for the gas mixture from the database, and substituting these values into the model equation, thereby obtaining a second equation for the molecular weight of the gas;

at a third temperature and pressure state of the gas mixture: measuring the speed of sound in the gas mixture, determining the constant values for the gas mixture from the database, and substituting these values into the model equation, thereby obtaining a third equation for the molecular weight of the gas; and

solving the three equations for the combined diluent concentrations of the gas.

9. The method of Claim 8, further comprising the steps of measuring the carbon dioxide concentration in the gas and subtracting the carbon dioxide concentration from the combined diluent concentration.

10. A two-channel device for measuring the nitrogen concentration in a subject natural gas, comprising:

a first gas flow channel, having a high pressure valve and a low pressure valve, a bypass valve for bypassing at least one of the pressure valves, a speed of sound sensor, a temperature sensor, and a pressure sensor;

a second gas flow channel, having a high pressure valve and a low pressure valve, a bypass valve for bypassing at least one of the pressure valve, a speed of sound sensor, a temperature sensor, and a pressure sensor;

a carbon dioxide sensor for measuring the carbon dioxide concentration in the gas; and

a processing unit for receiving speed of sound measurements from the speed of sound sensors, for receiving temperature and pressure measurements from the temperature and pressure sensors, for receiving the carbon dioxide concentration from the carbon dioxide sensor, for storing reference gas data, and for calculating the nitrogen concentration of the subject natural gas based on the speed of sound measurements, the temperature and pressure measurements, the reference gas data, and the carbon dioxide concentration.

11. The device of Claim 10, wherein the processing unit has a look up table for storing pre-calculated speed of sound values for a set of reference gases at a range of temperature and pressure states.

12. The device of Claim 10, further comprising a heater for raising the temperature of the gas during sensing by at least one of the speed of sound sensors.

13. A two-channel device for measuring at least one of the diluent concentrations in a natural gas, comprising:

a first gas flow channel, having a high pressure valve and a low pressure valve, a bypass valve for bypassing at least one of the pressure valves, a speed of sound sensor, a temperature sensor, and a pressure sensor;

a second gas flow channel, having a high pressure valve and a low pressure valve, a bypass valve for bypassing at least one of the pressure valves, a speed of sound sensor, a temperature sensor, and a pressure sensor; and

a processing unit for receiving speed of sound measurements for the speed of sound sensors, for receiving temperature and pressure measurements from the temperature and pressure sensors, for storing reference gas data, and for calculating at least one diluent concentration of a subject gas based on the speed of sound measurements, the temperature and pressure measurements, and the reference gas data.

14. The device of Claim 13, wherein the processing unit has a look up table for storing pre-calculated speed of sound values for a set of reference gases at a range of temperature and pressure states.

15. The device of Claim 13, further comprising a heater for raising the temperature of the gas during sensing by at least one of the speed of sound sensors.